

Coupled differential algebraic equations in the simulation of flexible multibody systems with hydrodynamic force elements

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The mathematical modelling of elastohydrodynamic fluid film bearings in combustion engines results in a coupled system of DAEs representing a flexible multibody system model of engine and bearing and the Reynolds equation that describes the nonlinear hydrodynamic effects in the fluid film. The hydrodynamic forces depend strongly on the position and elastic displacement of crankshaft and bearing shell.

In the present paper, we discuss the influence of space discretization on result accuracy and numerical effort. Since fine space discretization would slow down the numerical solution substantially, we propose an asymptotic analysis using methods from singular perturbation theory to speed-up time integration.

Numerical tests for a simplified benchmark problem will illustrate the benefits of this approach.